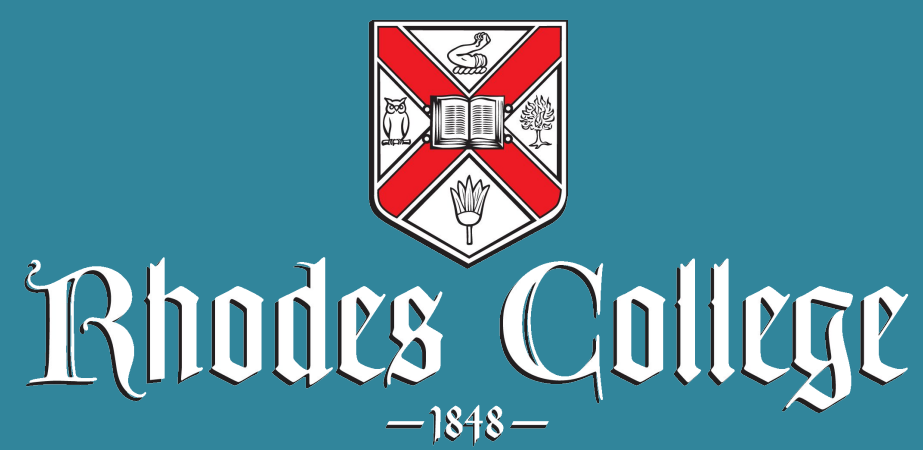


The Effect of Interpersonal Familiarity on Cooperation in a Virtual Environment

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Goal

Investigate the effect of interpersonal familiarity between two individuals collaborating on a task in an immersive virtual environment (VE).

Collaboration in Virtual Reality

Research into how individuals collaborate within VEs is currently a sparse field, but also an increasingly important one as more virtual reality platforms are released onto the consumer market. The effectiveness of collaboration, especially long distance collaboration, will impact virtual reality's adoption into business and internet applications. We hope to emulate this long distance collaboration by testing pairs of participants which are not allowed to meet or interact outside of the virtual environment.

Previous Research

Impact of virtual collaboration on real-world collaboration. [Qiu, Tay, Wu 2009]

- Participants who performed a task in a VE in a group as opposed to alone performed better on real-world collaboration tasks with the same group.

Factors which influence copresence and social presence in a VE. [Cho, Yim, Paik 2015]

- Age and epistemological beliefs were found to significantly influence both physical and social presence within a virtual classroom.

The effect of anthropomorphic avatars on presence in a VE. [Biocca and Nowak 2003]

- Participants interacting with avatars with low anthropomorphism reported higher levels of copresence and social presence.

Materials

- Two Oculus Rift HMDs (DK2)
- Two headsets with microphones
- Two computer mice
- WorldViz PPT motion tracking system



Figure 1: Example of avatars in the environment with all birdhouses visible.



Figure 2: Participant equipped for the experiment.



Figure 3: Two participants communicating during the experiment.

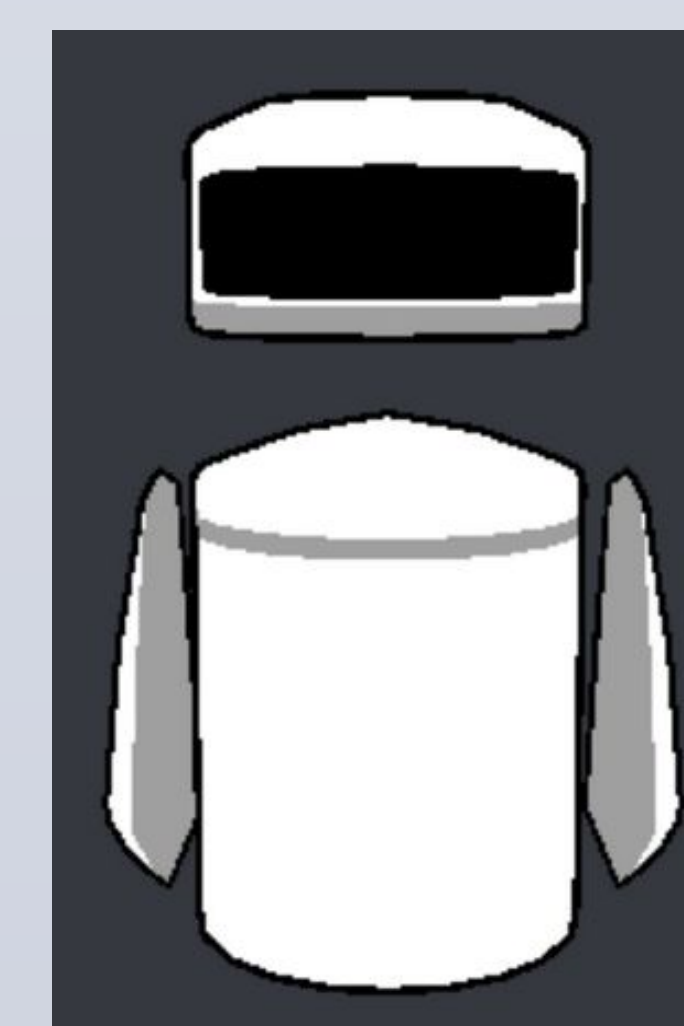


Figure 4: Anthropomorphic avatar model.

Dividing Line Task

In the virtual environment, two participants are placed on either side of a short wall bisecting an empty field. The participants cannot cross this wall. Once the round begins, a birdhouse will appear on one side of the wall, visible only to the participant on the opposite side of the wall.

Experimental Evaluation

Compare the performance on a collaborative task in a VE of pairs of participants allowed to meet prior to the experiment (Together groups) to pairs who only meet while in the VE (Separate groups).

Methods

32 subjects, divided into male/female pairs, participated in this study. Gender neutral, anthropomorphic avatars were used to prevent appearance bias while in the VE. Subjects were in communication during the trials via audio communication software. Position tracking and head orientation tracking were implemented in the experiment.

Conditions:

- Separate pairs: Not allowed to meet or communicate outside of the VE.
- Together pairs: Allowed to meet and communicate prior to entering the VE.

Task:

- Participant who sees the birdhouse guides their partner to stand on it and click their mouse.
- Participants switch roles after each birdhouse is visited for a total of 8 birdhouses.

Quantitative metrics are runtimes and number of incorrect mouse clicks per trial. Qualitative metrics are responses to surveys and face-to-face interviews.

Results

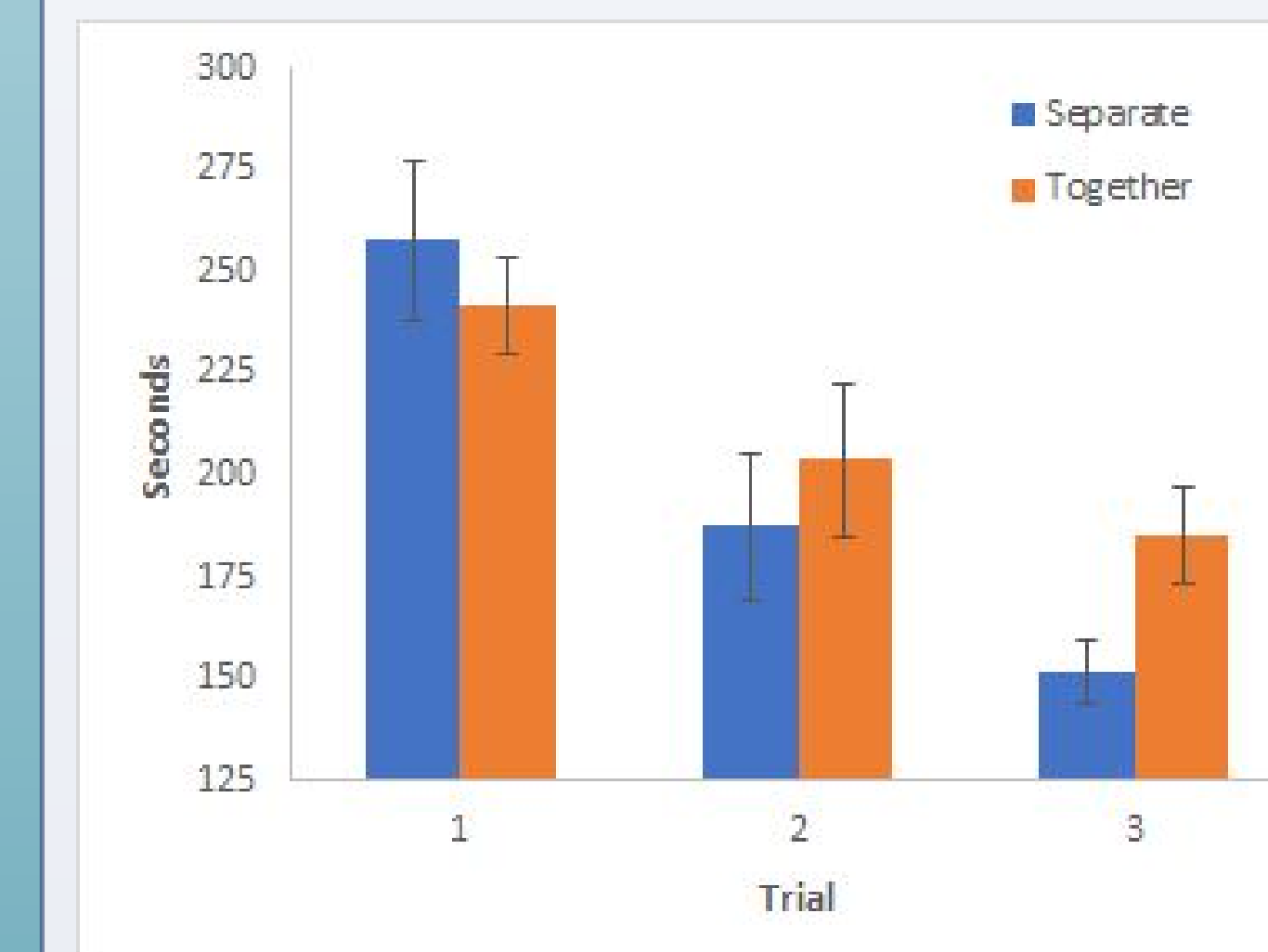


Figure 5: Average times of each trial measured in seconds.

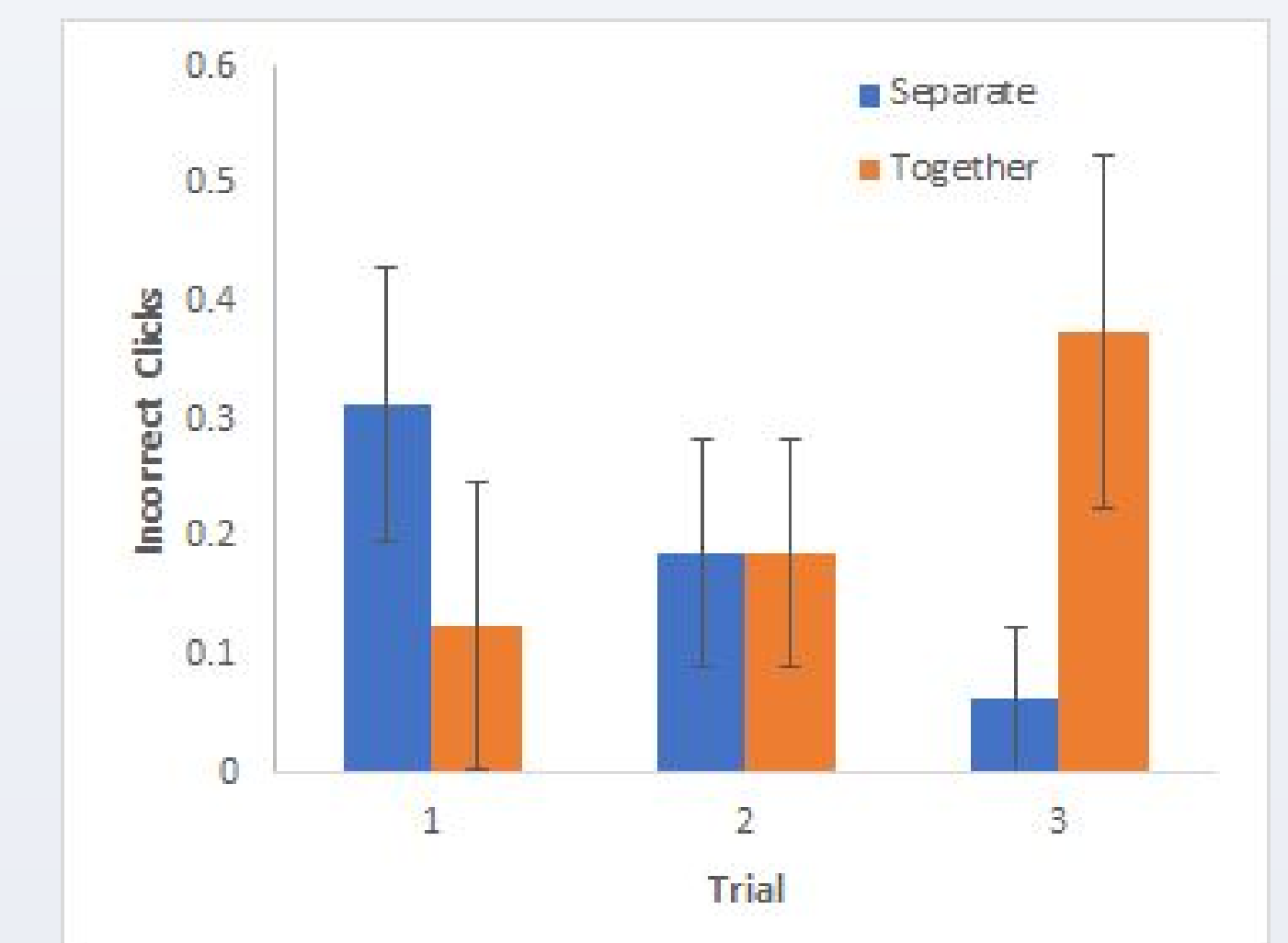


Figure 6: Average number of incorrect mouse clicks each trial.

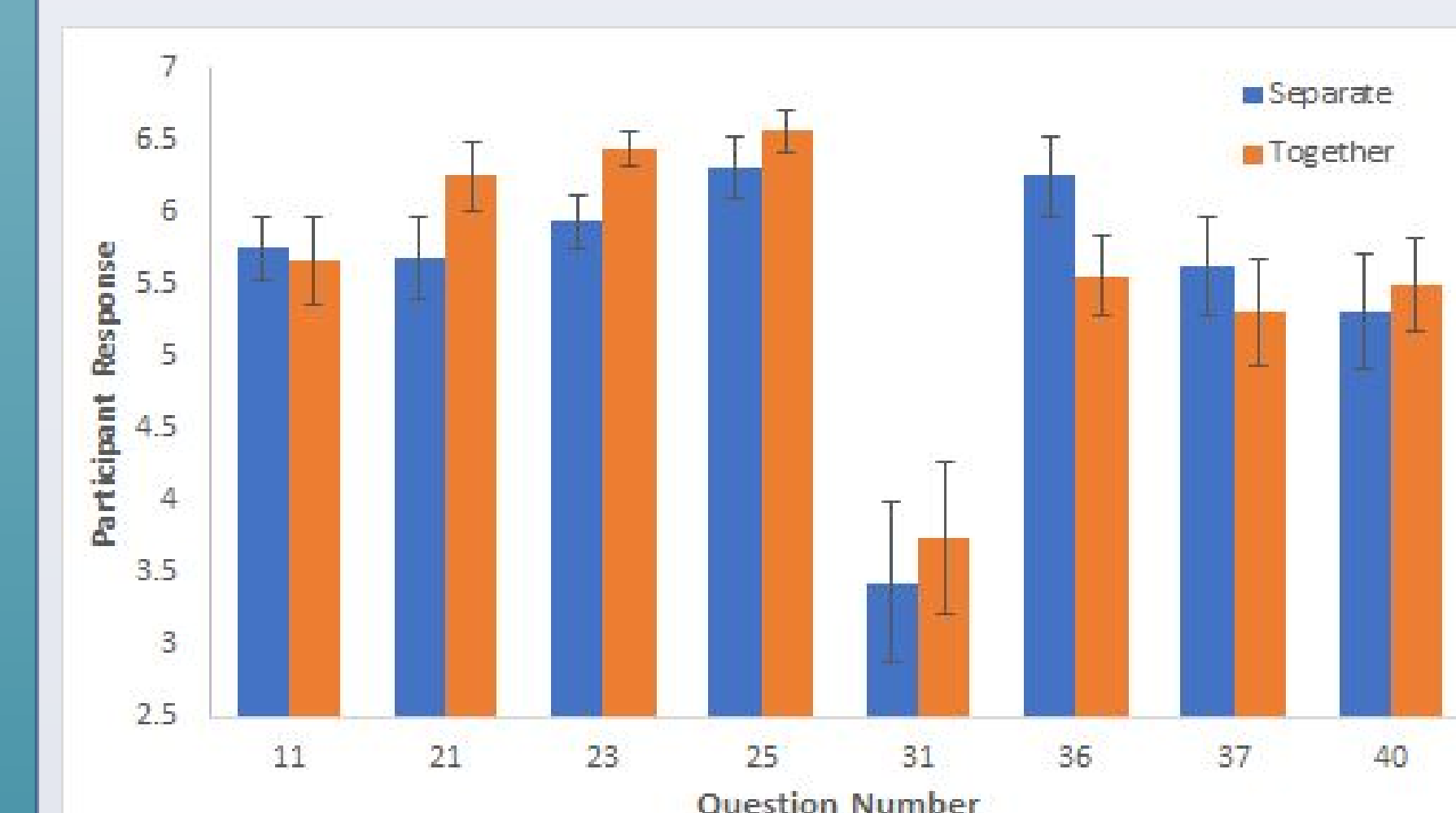


Figure 7: Average participant responses to selected questions on the post-experiment survey. Rating scale range is from 1 (strongly disagree) to 7 (strongly agree).

#	Question
11	They [your partner] are a likeable person.
21	My partner liked me and wanted to be helpful.
23	My intent was clear to my partner.
25	My partner's intent was clear to me.
31	Nonverbal communication through head movement was beneficial.
36	To what extent did your partner seem like a real person?
37	Would you feel more comfortable meeting a partner before working together in a virtual environment?
40	In the virtual world, I felt present and attuned to my surroundings.

Table 1: Questions relating to Figure 7.

Conclusions

Our data is still in the process of being analyzed but a preliminary look has yielded significant results.

The data shown in figures 5 and 6 suggests that, by the third trial, the pairs which were kept separate had better performance in terms of both time taken to complete the task as well as the accuracy of their mouse clicks.

The data in figure 7, particularly questions 21 and 23, suggests pairs which were kept together may have more positive feelings regarding their partner and their communication with their partner. The responses to question 36 suggest that pairs kept separate viewed their partner as more of a real person than the pairs who were allowed to be together.

Future Direction

Other factors to pursue further regarding collaborative VR:

- Testing homogenous as well as heterogenous gender pairings.
- Investigating factors which may negatively affect collaboration such as attitude, personality, or sense of authority. This may include the use of a confederate.
- Investigating the effect of the appearance of the avatar on collaboration.

References

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